Appendix F: Confidence Intervals

Confidence intervals have been reported in the data tables and as error bars in the graphs for all measures in the report. Confidence intervals indicate the reliability of the measure. A more thorough description of statistical reliability may be found in Appendix G of this report.

Although the confidence interval concept draws from the scientific literature on sampling theory, it is also relevant when measures have been calculated from the entire population. Public health studies typically draw on data over a finite time period. Health events do not occur at regularly-spaced intervals. Even though the underlying risk for a health outcome might be stable, the measurable health events, such as infant mortality, occur at random intervals. Thus, when we measure a health event over an arbitrary time period such as a calendar year, the measurement is taken from a sample in time. Therefore, each calculated rate (whether based upon survey data or count data) is an estimate and confidence intervals define a range in which the true score (which would represent everyone at all times) would lie.

The 95% confidence interval indicates the range of values within which the statistic would fall 95% of the time if the researcher were to calculate the statistic (e.g., a percentage or rate) from an infinite number of samples of the same size drawn from the same base population.

In public health practice, the casual user may think of a confidence interval as the range of probable true scores. The following statements are a logical extension of this thinking:

Observed measure:

- The infant mortality rate for Utah from 2004 to 2007 was 4.5 infant deaths per 1,000 births, with a 95% confidence interval from 4.2 to 4.8.

Logical corollaries:

- Thus, assuming this is a valid measure of infant mortality, there is a very high probability (95%) that the true score lies between 4.2 and 4.8 infant deaths per 1,000 births.
- The best estimate for the underlying risk in the entire Utah population is 4.5 infant deaths per 1,000 births, but the true risk might lie somewhere between 4.2 and 4.8.

The confidence interval may be used to ascertain whether a measure in a given community is statistically significant; that is, whether the difference is statistically higher or lower than the overall state rate. For example, the death rate for homicides in Utah (2005-2007) among Hispanic/Latinos was 4.4 per 100,000 population, with a confidence interval that ranged from 3.2 to 5.8. The lower limit of the 95% confidence range (3.2) is greater than the overall state rate of 1.9 deaths per 100,000 population. Therefore, it can be said that the homicide death rate in Utah's Hispanic/Latino population is higher than the state rate, and that the difference is statistically significant. Please note, however, that a difference can be meaningful without being statistically significant. The point estimate (in this example, 4.4) is still the best estimate of the underlying risk. We need to be mindful of the confidence interval, but we should not be overdependent on it in interpreting results.

Appendix F: Confidence Intervals

The following methods were applied in order to estimate the confidence bounds in these circumstances:

Count Data

Inverse Gamma Distribution was applied to count data.

Anderson RN, Rosenberg HM. Age Standardization of Death Rates: Implementation of the Year 2000 Standard. National vital statistics reports; vol 47 no. 3. Hyattsville, Maryland: National Center for Health Statistics. 1998.

Survey Data

Confidence intervals for survey data (BRFSS, PRAMS, and UHAS) were calculated using a log transformation. Confidence intervals were constructed for the log prevalence using SUDAAN standard errors and exponentiated to produce bounds for the prevalence of estimates.

Korn EL, Graubard BI. Analysis of Health Surveys. Wiley: New York, 1999:66.